I - Report on Application of Automatic Data Processing (ADP) to Modernization of the Maryland Government. By - Kiehne, Ernest W.

2 - A Program of Operations Research for the State of Maryland. By - Cushen, Walter E.

* FASTENED TOGETHER

STATE OF MARYLAND
DEPARTMENT OF ECONOMIC DEVELOPMENT
STATE OFFICE BUILDING
ANNAPOLIS, MARYLAND 21401

Dear Sir:

The attached reports by Mr. Kiehne and Dr. Cushen of the Governor's Science Resources Advisory Board are made available to you with the report of the Commission for the Modernization of the Executive Branch of the Maryland Government because it is believed that they will serve to complement the Commission's study and recommendations.

The Report on Application of Automatic Data Processing (ADP) to Modernization of the Maryland Government by Ernest W. Kiehne, Chesapeake & Potomac Telephone Company of Maryland, and A Program of Operations Research for the State of Maryland by Dr. Walter E. Cushen, National Bureau of Standards, were prepared at the request of the Governor to supplement and particularize those recommendations of the Commission for the Modernization of the Executive Branch of the Maryland Government pertaining to automatic data processing and operations research.

These studies represent a major investment of time and talent by the authors, both of whom have displayed a sense of dedication to their tasks as well as a high degree of public spirit and responsibility. In his letter transmitting these studies to the Governor, Mr. Walter Hamilton, vice chairman of the Science Resources Advisory Board, wrote, "Both Mr. Kiehne and Dr. Cushen are highly qualified in their respective fields and have made thorough investigations before completing their reports, which I regard as major contributions toward fulfilling the goals outlined in your message of March 22nd."

The principal value of these reports, it is anticipated, will be in the guidance and assistance they contain for those individuals who will have the on-going responsibilities to develop and execute the modernization and re-organization program.

Sincerely,

John Hosford

John Hosford, Secretary
Governor's Science Resources
Advisory Board

REPORT ON APPLICATION OF AUTOMATIC DATA PROCESSING (A.D.P.) TO MODERNIZATION OF THE MARYLAND GOVERNMENT

November 1966

Ernest C. Kiehne, General Staff Supervisor - Data Processing
The Chesapeake and Potomac Telephone Company of Maryland

Executive Summary

At the current growth rate, it is predicted that State Governments will soon be unable to hire the personnel necessary to satisfy the increasing demand for government services. Unless operations are modernized, state budgets will continue to spiral without commensurate improvement in service. It is this Committee's conclusion that continued support by top State officials for the orderly computerization of State operations is essential to the resolution of cost, service and employee hiring problems. Through aggressive introduction of computer systems (A.D.P.), measurable improvement in Maryland government expense and service should be achievable in three years, substantial improvement in six, and dramatic gains in ten.

Second only in importance to continued high level support for A.D.P. is the difficult and lengthy task of building a strong, professional State Data Processing Staff. This report estimates that a minimum of 125-150 computer programming personnel will be required to mount and sustain an effective statewide A.D.P. effort. To recruit and retain this staff, the State must pay competitive salaries for professional A.D.P. personnel, offer opportunities for advancement and provide top-flight working conditions.

The report recommends that the State A.D.P. organization be built around a strong Central Control Staff, located in the Department of Budget and Procurement, and supported by several satellite programming staffs, One satellite group would service the State Comptroller's operation; another the Department of Motor Vehicles, State Police and State Roads Commission. A third group, physically located with the Central Staff, would support the 100-plus smaller state agencies, departments and commissions. The University of Maryland computer operations should be autonomous.

The Central Staff would exercise a strong statewide A.D.P. control and planning function. Among its many important responsibilities, this group would:

1. Prepare or review all feasibility studies for new A.D.P. applications.
2. Develop plans for the short and long range computerization of the Maryland Government.
3. Evaluate new computer hardware and maintain control over its acquisition.
4. Make certain that all State A.D.P. personnel follow the same standard computer programming and operating procedures.
5. Encourage increased A.D.P. coordination between Federal, State and Local jurisdictions.

The State of Maryland has a number of operations that are excellent candidates for A.D.P. However, over the next several years, emphasis should be placed on the computerization of the State Comptroller, Department of Motor Vehicles, Law Enforcement (State Police) and State College applications. In 10-12 years these four A.D.P. applications, augmented by a number of others, can develop into an integrated, computerized State Information System (S.I.S.).

In several years the State Legislative process will be a fine candidate for computerization.

The University of Maryland has an excellent Computer Science Department and associated computer operation. With positive support this organization can become one of the best in the United States. Such an achievement will draw outstanding students, teachers and researchers to the University and provide a strong attraction for science-based industry to settle in Maryland.

All 50 states face the same A.D.P. problems and generally will be required to computerize the same applications. The Council of State Governments should be encouraged to establish a super "clearing house" A.D.P. Staff to serve the uniform problems of the 50 states. The shared cost of such a staff would be infinitesimal when contrasted to its worth.

In its future office building plans, the State should carefully engineer and provide the space and working conditions necessary for A.D.P. activities.

The report is silent as to preferability of one computer manufacturer's hardware versus that of another, since a number of vendors appear to offer competitive equipment.

It is recommended that an A.D.P. Advisory Committee be appointed to counsel the State of Maryland over the next several years. This Committee should consist of members of the business community competent in computer operations and interested in advancement of State Government.

"APPLICATION OF AUTOMATIC DATA PROCESSING (A.D.P.) TO MODERNIZATION OF THE MARYLAND GOVERNMENT"

The Need for A.D.P. in State Government Operations

The continuing increase in State Government budgets and numbers of State employees has been widely noted. The following table presents this story for Maryland:

*State of Maryland

Year	Employees	Budget
1946	10,043	$ 67,000,000
1950	14,773	151,000,000
1955	16,579	237,000,000
1960	21,919	448,000,000
1965	28,454	678,000,000
1966	30,000	765,000,000
1967	32,000 (Approx.)	885,000,000
1970	?	?

*Budget includes Federal funds

This pattern is probably common to all states. At the current growth rate, it is predicated that in relatively few years, state governments will be unable to hire the personnel necessary to satisfy the increasing demand for government services. Unless operations are modernized, budgets will continue to spiral, without commensurate improvement in service. Business, particularly in the service and utility industries, has been faced with the same cost, service, and employee hiring problems. To combat these, business in recent years has turned increasingly to the modern technology of A.D.P. (or computerization). The tremendous growth of the computer industry bears testimony to the confidence that business and industry place in this technology. Knowledgeable people, within and outside government, are in agreement that business techniques can be readily applied to State government.

It is this Committee's conslusion that continued aggressive support by top State officials for the orderly computerization of state operations will have a most salutary effect. Measurable improvement in State government expense and service should be achievable in three years, substantial improvement in six, and dramatic gains in ten.

Nature of A.D.P.

Automatic Data Processing essentially implies the design, programming and implementation of computer systems or applications. It also includes the development of the manual or clerical input/output procedures

that must accompany all such computer efforts. A.D.P. may also call for the use of data transmission, video displays, punch card equipment, etc. Virtually all State government activities, including law enforcement, tax administration, revenue estimating, expense control, motor vehicle registration, state college administration, the legislative process and welfare administration, appear to be strong candidates for Automatic Data Processing.

A.D.P. Sub-Committee - Membership and Approach to Subject

The A.D.P. sub-committee, in addition to Mr. Kiehne, included Mr. William Zeidler and Mr. Joseph Haeffner. Both of the latter men have had considerable practical and supervisory experience in computer programming and operations. The committee visited all State computer centers, consulted with State A.D.P. personnel, studied A.D.P. organizations in other states, talked with outside consultants, met with vendors of State leased computer hardware, visited Baltimore County and Baltimore City A.D.P. centers, and reviewed various books and other written material on the subject of State government A.D.P. All State of Maryland personnel interviewed were most cooperative and helpful.

The main emphasis of this report is directed to State A.D.P. organization and to the development of a strong State A.D.P. staff capability. The report is silent on the subject of computer hardware selection since the Committee considers a number of computer manufacturers to be currently fully competitive.

The Committee will be pleased to meet at any time with State officials or managers who wish to pursue the A.D.P. subject in greater detail than presented here. Although this report is essentially optimistic as to the State's A.D.P. future, we believe its suggestions and objectives to be practical and achievable.

Maryland Government Current A.D.P. Status

The State has a number of separate computer operations, the earliest dating back to about 1962. These are:

	Agency		Type	Memory
1.	Welfare	- IBM	1440	12K
2.	Employment Security	- IBM	1401	12K
3.	Maryland State Police	- Univac	1004	1K
4.	State Roads Commission	- IBM	1620	40K
5.	Baltimore Data Processing Center	- IBM	1460	16K
6.	Morgan State College	- IBM	1620	20K
7.	University of Maryland - Comptroller	- Honeywell	200	24K
8.	University of Maryland - Health Science Computer Center	- IBM	1620	60K

9. University of Maryland - Computer Science Center	- IBM	7094	32K
University of Maryland - Computer Science Center	- IBM	1401	16K
10. State Comptroller - Annapolis	- IBM	1401	16K
11. Department of Motor Vehicles	- Univac	1050	32K

All of these operations, with the exception of the University of Maryland, are of modest proportions. In the overall, State of Maryland progress in introducing Automatic Data Processing has been about average for the 50 states.

An acute shortage of competent Data Processing personnel exists. Only 34 systems analysts and computer programmers are included in the entire State payroll (excluding University of Maryland). The loss rate and turnover within this group has been heavy - and in some specific areas crippling.

However, the course of State A.D.P. development has merely paralleled that of outside industry, where A.D.P. growing pains have been the rule rather than the exception. Developing and maintaining a professional computer staff and operating organization is a difficult and lengthy process. State A.D.P. personnel are to be complimented for having made the progress they have under such adverse conditions as poor staff salaries, crowded conditions, etc.

The enactment of Chapter 132 of the Acts of 1966, Senate Bill 279, in June 1966, authorizing the establishment of a central Automatic Data Processing Staff in the Department of Budget and Procurement has been beneficial in speeding up the State A.D.P. process. This new staff has the responsibility for planning and controlling automatic data processing throughout the Maryland Government. The Budget Bureau was most fortunate when it obtained the services of Mr. A. J. LaPenotiere to head this group. Mr. LaPenotiere has many years of professional background in A.D.P. and brings technical experience and competent leadership to the group. This small staff, which now numbers four persons, must serve as the catalyst and coordinative influence for a "leap forward" in State A.D.P. capability.

Continued Positive Support by High Level Government Officials for A.D.P. Most Important Requirement

The essential ingredient for successful State computerization, now and in the future, is continued aggressive and enthusiastic understanding and support by top State officials. Elected officials and high level government managers probably cannot, and need not, have a technical knowledge of A.D.P. However, they can develop a basic understanding and comprehension for the great contributions this technology can bring to State government. One way to achieve such understanding is to invite officials to attend short duration, local A.D.P. seminars sponsored by computer vendors or to visit the factories and laboratories of these

manufacturers. Vendors are qualified and naturally anxious to offer such computer orientation. The State Central A.D.P. Staff could plan an orientation course for Legislators and State executives. Computerization of the Legislative process could greatly influence the interest of Legislators. However, it will undoubtedly be several years before this job can be programmed. Measurable success by State A.D.P. Staffs in completing several basic "show piece" computer applications, i.e., Comptrollers, State Colleges, Motor Vehicles, etc. can beneficially influence the support and confidence of State officials. In summary, every possible method should be employed to educate State leaders in the importance and value of Automatic Data Processing to the Maryland Government.

Building a Strong State A.D.P. Staff Capability is Mandatory

Second only in importance to continued high level support for A.D.P., is the recruiting and development of a strong, professional State Automatic Data Processing Staff. Ways must be found to recruit and develop top flight computer analyst-programming personnel. In the computer trade, an outstanding analyst-programmer may have four times the productivity of an average analyst-programmer. A below average analyst-programmer cannot perform the job at all. History has proven that a non-competent, non-professional A.D.P. Staff is a debacle.

At present the State A.D.P. Staff posture is quite weak numerically. As stated previously, excluding the University of Maryland, there are only 34 analyst-programmers in the total State payroll. For the long pull it can be broadly estimated that the State will need 125-150 analyst-programmers to mount and sustain a satisfactory A.D.P. effort. By January 1, 1968 total A.D.P. Staff personnel should be increased to at least 70 and by January 1, 1970 to at least 100. The cost of this increase in professional personnel is modest when related to the great savings in administrative personnel and expense that will accrue from an effective Automatic Data Processing effort.

For the short range, to promptly build staff capability, it will be necessary for the State to actively recruit experienced personnel from outside the State organization and assign them to responsible A.D.P. Staff positions. For the long range, from a Staff morale and stability standpoint, it will be far better to build most of the Staff from within and from the ground up. Ways must be found to test and recruit qualified, interested A.D.P. candidates from the entire State personnel universe. We believe that among 30,000 plus State employees, there must be at least 70 unknown candidates who will thrive and produce capably as computer analyst-programmers. The State colleges must be also looked to as a fine source for analyst-programmers. Another good source for A.D.P. Staff personnel is from among bright high school graduates, without prior programming experience, who have several years experience in the business world or in the military service. Still another good supply area is among the large number of A.D.P. qualified persons attending evening colleges. Building a strong staff calls for creative and aggressive recruiting. However, Maryland has proven to be an excellent state in which to locate and hire qualified persons for Automatic Data Processing.

In recruiting personnel it is important that they be thoroughly tested for potential programming aptitude. In order to have a "national benchmark" for applicant evaluation it is suggested that all State programmer candidates be given the SCAT test as well as either the I.B.M. Programmer Aptitude Test (PAT) or the NCR Aptitude Test currently being given.

Salary Treatment for State A.D.P. Staff Personnel Must be Competitive with Industry and the Federal Government

Attraction and retention of qualified professional A.D.P. Staff personnel depends upon three basic factors:

1. Challenging work
2. Opportunity for advancement based upon merit
3. Salaries competitive with those paid by outside industry and Federal government

As to Item No. 1, computer analyst-programming work is by nature challenging and stimulating for those who have the native ability to produce in this area of endeavor. State A.D.P. applications such as law enforcement, motor vehicles, tax accounting, state hospitals, and dozens of other State jobs are as exciting and demanding as any computer applications in private industry.

As to Item No. 2 and 3, the staff of the office of the Commissioner of Personnel appears to have performed an excellent job over the past several months in reappraising the salaries, levels and credentials of State systems analyst-programming jobs. In the past the State has suffered a severe loss of qualified A.D.P. personnel because of inadequate pay treatment. New salary scales have been proposed that generally appear competitive with outside business. For example, a top Systems Analyst-Programmer may earn up to $13,600 under the new plan. A college graduate inexperienced applicant may be offered up to $7,000 starting salary. A bright inexperienced high school graduate can be paid $5,000 starting. One modest weakness in the new salary plan that should be reviewed concerns the difficulty in hiring for analyst-programming work, bright, qualified high school graduates, or evening college students, who have considerable business experience in such fields as accounting, electronics, engineering, etc., but lack programming experience. This type person frequently is the best applicant, but because of family responsibilities or current salary, etc., cannot accept a starting salary of about $5,000 as proposed in the plan. It would be desirable for the State to be able to offer such outstanding candidates up to perhaps $6,500 starting salary, depending of course upon the qualifications of the applicant.

Other A.D.P. Staff Development Considerations

The proposed levels for State Analyst-Programmer jobs (ten in number) appear to offer sufficient flexibility and scope for merit

promotional opportunity. As total State A.D.P. staff capability increases, it will be desirable if more "inter-A.D.P. staff" promotional opportunities can be offered to qualified candidates. For example, if a Systems Analyst IV opening develops in the Central Staff, it would be a morale builder if a Systems Analyst III could be promoted to the job from the Comptroller's Staff. Or if a Programmer III opening occurred in the Central A.D.P. Staff, a Programmer II on the Department of Motor Vehicle Staff could be considered. This would also be desirable from the standpoint of developing inter-A.D.P. Staff flexibility and total State staff job knowledge.

It also appears desirable, when A.D.P. job promotional opportunities occur, to gradually reduce the emphasis placed upon oral and written promotional examinations, and to place more emphasis upon the collective performance appraisal of the various A.D.P. top staff supervisors. It is recognized that accomplishing this may be difficult in light of the importance of retaining confidence in the validity of the State merit promotional system.

An effort should be made to keep the number of State computer analyst-programming job titles to a minimum, i.e., the ten titles mentioned above for analyst-programmers seem adequate and satisfactory for the time being. As a minor point, for reasons of statewide uniformity, it would be desirable if the title of the A.D.P. personnel in the State Roads Commission were changed from Data Processing Engineer to agree with those in use throughout the rest of the State.

As the State A.D.P. staff capability and effort accelerates, competent leadership will be required to supervise and coordinate the several A.D.P. staffs. These top A.D.P. supervisors must be a mixture of administrator and professional technician - a combination hard to come by. In outside industry, these A.D.P. Staff leaders are well paid. The State for its top A.D.P. Staff supervisory jobs may be required to pay at least $17,000-$18,000, at the current market, to attract and hold persons of the necessary professional caliber.

In Maryland, over the next five years, there will be a continuing increase in demand for competent analyst-programmers. Therefore, State personnel people and A.D.P. Staff administrators must keep careful track of outside industry salary trends to keep State A.D.P. salaries competitive.

Another item of importance relevant to staff morale and efficiency is the provision of satisfactory working space for A.D.P. staff personnel. The space subject will be discussed later in this memorandum.

Finally, it is desirable that A.D.P. staff personnel be allowed to visit other State A.D.P. installations, to attend various regional and national A.D.P. seminars, to attend out-of-state advanced programming schools, etc. Within the constraints of the budget, activities of this type for staff members should be encouraged.

The Development of a Strong Computer Operating Organization is Also Essential

In building a strong State Automatic Data Processing capability, considerable effort must also be directed to the development of a competent computer line operating organization (as opposed to staff). This organization manages and operates the computer processing. It includes such jobs as computer console operators, tape handlers, input/output control clerks, and tape librarians. It also includes such supervisory jobs as a first level Computer Room Manager and his second level supervisor, who may have a title such as Data Processing Operations Supervisor. This second level supervisor may have responsibility for the Computer Room - plus such peripheral operations as the Tape Library, Key Punch, Input/Output Control and Tab equipment functions.

Contrary to some popular belief, the management of computer centers calls for an excellence and precision of supervision exceeding that required for non-mechanized operations. A well-programmed computer system will produce few errors. However, when they do occur, these mistakes can be big ones. They are invariably the result of human error and frequently are both embarrassing and difficult to correct. Consequently, competent, technically proficient and vigilant persons must be selected to manage the computer operation. Desirably, these managers would be experienced programmers.

Until recent years it has been the practice in industry to assign the majority of computer operating clerical jobs to men. However, the trend has now shifted towards hiring qualified, high school graduate females for these assignments. Men should only be assigned to the jobs of tape handler, console operator, input/output control, tape librarian, tab operator, etc., if they possess the mental and personality qualifications to later become good analyst-programmers. This latter hiring approach can provide an excellent reservior of programming talent for the long pull.

This Committee would like the Commissioner of Personnel and the Central Staff A.D.P. people to review the Computer Room operating job classifications at their convenience. A suggested approach to slotting these jobs might be:

Operations Manager (Second Level)	Salary $10,000-$13,000 Works Prime Shift Supervises Computer Room - All Shifts - Associated Key Punch and Tab Equipment Operations, Tape Library, Input/Output Control
Computer Room Supervisor	Salary $6,000-$9,000 Works Any of Three Shifts (Any 5 of 7 Days Per Week) Supervises Computer Room and Possibly Tape Library and Input/Output Control

Data Processing Clerk I & II	----	Salary $3,600-$5,100 (Should Receive Evening, Night, and Sunday Pay Differentials) Works Any Three Shifts (Any 5 of 7 Days Per Week) Includes Tape Librarian, Tape Handlers, Input/Output Control Clerks, Console Operators

In this type of organization the Operations Manager would report directly to a person with a title such as "Chief, Data Processing Division" who also may have responsibility for the programming staff associated with the particular computer operation. This approach could reduce the variety of job titles currently assigned to State A.D.P. operating jobs. It would provide for greater flexibility of job assignment and should improve efficiency of operation. All members of the line operating organization should be considered candidates for analyst-programming jobs - and vice versa where appropriate.

Fitting Automatic Data Processing Into the Maryland Government Organization

The next pages of this report explore the current Maryland Government Automatic Data Processing organization. Brief comments are made concerning each of the existing A.D.P. Staffs and their planned computer applications. Suggestions are made for some changes and upgrading in the A.D.P. organization - both for the short and long range.

Centralized vs. Decentralized A.D.P. Staff Organization

Expert opinion on State government organization varies widely in its views concerning the pros and cons of centralized vs. decentralized Automatic Data Processing organization. Some advocate 100% centralization. Others recommend complete departmental or functional decentralization. A third and substantial group advises the establishment of a strong central control A.D.P. Staff supported by a minimum number of satellite staffs, each organized for a large individual department or around a natural major grouping of State functions.

For any State, an uncoordinated, fragmented, multi-staffed, decentralized A.D.P. Staff operation is impossible. For the small state, gradual coordinated 100% centralization of staff may be possible. For the larger and rapidly growing states, complete staff centralization offers an heroic chore that could take many years to accomplish, and at best may prove to be both clumsy and unresponsive to state operational needs. This Committee favors the "strong central control staff plus peripheral staff approach" for Maryland. Senate Bill 279 established a legislative base for this approach by placing the Automatic Data Processing planning and controlling function in the Department of Budget and Procurement. Mr. LaPenotiere has organized his Central Staff along these lines and based his longer range plans upon this philosophy.

Central A.D.P. Staff Role and Functions

The Central A.D.P. Staff located in the Department of Budget

and Procurement currently consists of three System Analyst plus Mr. LaPenotiere. It is physically situated in Baltimore on the 15th floor of the State Office Building. This group is professionally quite competent, but must be increased substantially in number to carry out the many important functions envisioned by this report. By the end of calendar 1967 this group should be increased to a minimum of eleven professional personnel whose functions would include:

1. Planning for the short range, intermediate term (5 year), and long range computerization of the Maryland Government.
2. Preparation of feasibility studies for various applications.
3. Review of feasibility studies developed by other State A.D.P. Staff groups.
4. Evaluation of new computer hardware and maintenance of control over its acquisition.
5. Insurance that all State computer programming and documentation procedures follow a prescribed standard, and uniform pattern. This is urgent and will be discussed later in this memorandum.
6. Implementation of uniform statewide computer operating, computer scheduling and computer control procedures.
7. Implementation of standard computer utilization measurement procedures and forms.
8. Implementation of common statewide programming languages. The use of COBOL (Common Business Oriented Language) should be encouraged.
9. Development of standard statewide training practices and procedures. This applies to the training and development of both analyst-programmers and clerical personnel. The subject of good, effective training methods for both government and industry is virgin territory. This memorandum will refer to the training subject later.
10. Coordination of statistical reports outputs within the Maryland Government structure and also between the Federal and Maryland Governments, between the Maryland Government and those of other states and between Maryland State and Maryland local jurisdictions. This is an important activity that will be accentuated as the Federal Great Society and other programs are speeded up. The Council of State Governments is currently encouraging this important and needed effort.
11. Encouragement and development of closer A.D.P. coordination between Federal, State and local jurisdictions.
12. Location, study and review of successful and proven A.D.P. applications being developed by A.D.P. organizations in other states. Effort should be made to gain as much interstate A.D.P. transferability as possible.

13. Development of performance standards for both operating and Staff A.D.P. personnel.

Interagency Data Processing Should be a Function of the Central Staff

In addition to the A.D.P. control functions mentioned above, the Central Staff should also assume responsibility for development of computer procedures for most of the many Staff agencies either too small, or professionally not equipped, to implement efficiently their own A.D.P. methods. This will require recruitment and assignment to the Central Staff of a number of programming staff groups organized to the extent possible around natural groupings, i.e., State Colleges and Education (excluding the University of Maryland which probably should and will be autonomous), Health and Welfare, Correctional Institutions, and a variety of other departmental and agency activities.

Establishing of an Interagency (I.D.P.) Data Processing Center

The I.B.M. 1460 computer located in the State Office Building in Baltimore is presently under control of the State Comptroller. This computer currently is used primarily for servicing the Medicare program for the State Department of Health. It is recommended that operation of this machine be transferred to Central Staff control as soon as practicable. This computer would serve as the nucleus of a state "Interagency-Interdepartmental Data Processing Center." The activities of this center will expand rapidly in variety and volume. As mentioned above, programming of applications for the I.D.P. Center should be organized and carried out under the supervision of the Central Staff. It should prove efficient to consolidate the A.D.P. services for the State Department of Health and the Department(s) of Public Welfare in this center. Computer hardware capacity will need to be upgraded and increased in the I.D.P. Center as Interagency demand for A.D.P. services accelerates. Any plans for expanding state office building space in Baltimore should contemplate adequate space for this operation. It is likely that 10,000-13,000 sq. ft. of office space will be needed in three to four years to support the Central Data Processing Staff and associated (I.D.P.) computer operations.

A.D.P. for the State Colleges

The Central Staff in the Department of Budget and Procurement has selected a computer to provide the data processing services for Morgan, St. Marys, Bowie, Coppin, Frostburg, Salisbury and Towson State Colleges. A Honeywell H-1200 computer has been selected and the system will be implemented on a computer time sharing basis. Hardware will be located at Towson State. Remote input/output devices will be installed at the other six state colleges. A programming staff is now being recruited and will be supervised by the Central Staff. Honeywell is providing three full time systems development support personnel. Initially this system will provide administrative services for the State Colleges. Later the computer prime shift will be employed for student and faculty research projects and programmer training activities. This appears to be a desirable, well-planned application. State college employment of

computers will increase rapidly in future years, both for the purposes listed above, and to provide computer-assisted training for students. Eventually, Community Colleges and many secondary schools will effectively employ computers.

It is planned that the State College computer will have time available for processing statistical data for the State Department of Education relative to elementary and secondary education. Also, it should have time to produce reports for the Advisory Council for Higher Education and for the Board of Trustees for State Colleges. The Committee feels that, for the intermediate term, (i.e., 3 to 4 years) supervision of the State College A.D.P. system should remain under control of the Central Staff. For the long pull it may prove practical to make this an autonomous A.D.P. operation, similar to the University of Maryland. In the future, it will be desirable to encourage A.D.P. cooperation and coordination between the University of Maryland and the other State Colleges.

It will probably prove practical and useful for all major State College computer installations to be "tied in" by data communication links.

A.D.P. for the Department of Mental Hygiene

A study is now being conducted by the Central Staff to determine the feasibility of centralization of A.D.P. services for ten State mental hospitals. The same approach to the solution of this problem will be taken as that pursued for the State Colleges; that is, a central computer at one hospital with remote input/output devices and communication over leased lines to the other facilities. This also appears to be a practical and desirable application. The Central Staff should also assume responsibility for programming this application. However, the Committee believes it prudent that this project be moderately delayed until the Baltimore Interagency computer operation is fully staffed and operational and until the State College application is safely and securely under way.

Central A.D.P. Staff - Long Range Considerations

The State Central A.D.P. Staff inevitably will be a large and important organization that is vital to an efficient State operation. It will probably consist of at least 60-70 professional A.D.P. Staff personnel. There will be a constant and increasing demand for A.D.P. services by the many smaller state departments, agencies and commissions as the worth of efficient computerization is proven. Statewide A.D.P. control and programming functions will increase in complexity and magnitude. For the intermediate term it is both desirable and effective to slot the central A.D.P. organization in the Department of Budget and Procurement. For the long range, the top man in the centralized A.D.P. organization may have to be Department Head level and report directly to the highest level of state supervision. Should a Department of Administration someday be established for the Maryland Government, it may be proper to fit the Central A.D.P. Staff into this organization with the State Chief of Automatic Data Processing reporting directly to the top state administrator.

A.D.P. for the Comptroller of the Treasury

The State Comptroller's operation is a large and important activity that is well suited for computerization. At present the Comptroller's A.D.P. operation is located in the State Office Building at Annapolis. A modest number of programs, concerning mostly State Payroll and fuel Tax Division activities, are currently being processed on an I.B.M. 1460. The programming staff is quite small and has experienced several losses of personnel.

Consultants of the firm of Ernst and Ernst, at the Comptroller's request, have thoroughly reviewed the total Comptroller's operation and have prepared a computer feasibility study. In their report, dated June 1, 1966, they have made specific recommendations calling for a substantial increase in the use of A.D.P. techniques for the Income Tax Division, Retail Sales Tax Division, General Accounting Department, Central Payroll Bureau, Alcoholic Beverages and Admissions Tax Division, Gasoline Tax Division and the License Bureau. Ernst and Ernst has had experience across the nation in working with and recommending modernization of State government operations. The application recommended have considerable merit and should be implemented without delay.

Accomplishing this will require a major A.D.P. Staff recruiting effort. Of primary importance, a top professional A.D.P. administrator must be hired from the outside to head up both the Comptroller's Staff and computer line organization. He should be hired as promptly as an outstanding candidate can be located. Finding this person may require paying as high as $16,000-$18,000 per year. Once employed, this person should immediately concentrate upon recruiting the remainder of the A.D.P. staff. Ernst and Ernst estimates that his staff should total approximately 35-40 persons. Recruiting and developing a competent staff of this size will be difficult and time consuming. Development of the entire computerized Comptroller's operation may require 4-5 years of concentrated effort.

Completion of this job will provide many advantages to the state. It should ultimately provide substantial expense savings and a far more efficient and responsive Comptroller's operation. It will provide a tool for measuring the effects of proposed tax reforms and an excellent facility for handling any statewide tax reform plans that are introduced. It will also provide the vehicle for introducing an improved statewide accounting system. It is recommended that Ernst and Ernst be retained as consultants to coach and counsel this application. However, Ernst and Ernst should not be hired to program the effort.

The hardware vendor for this application should be asked to provide three full time systems support personnel for a period of at least 27 months (i.e., similar to Honeywell's support of the State College Project).

The Comptroller's I.B.M. 1401 in Annapolis currently is performing a small amount of Interagency (non-Comptroller) A.D.P. Although this report recommends that the bulk of Interagency processing and programming be per-

formed at the proposed Baltimore Interagency A.D.P. Center (under control of the central staff), it seems logical for the Annapolis operation to continue handling these particular programs. From a practical standpoint, it may be efficient for the Annapolis operation to eventually program and operate A.D.P. activities for all State Natural Resources Departments located at Annapolis.

It is suggested that the Comptroller's A.D.P. Staff, because of its size and importance, permanently be a separate staff peripheral to the Central Staff. However, it would operate under the control of the Central Staff, whose duties and control functions are described on Page 11 of this memorandum; i.e., it would follow standard statewide programming and computer operating procedures, program in COBOL, consult with the central staff concerning hardware acquisitions, etc.

A.D.P. for the Department of Motor Vehicles

The Department of Motor Vehicles operates a Univac 1050 computer equipped with direct access drums. D.M.V. has a staff of about five analyst-programmers. This group has programmed an application for the recording and "real time" retrieval of information on any one of 700,000 drivers in the state who have been quilty of one or more driving violations. This application should be cut over to computer operations by early 1967. The D.M.V. staff has also programmed the "ticket" accounting function. This job will be converted to computer operations in the near future. The staff is also studing the vehicle titling and registration function involving 1,600,000 license tags per year. This will be programmed as staff time becomes available. D.M.V. is to be complimented on their accomplishments and their forward looking approach. The D.M.V. staff should be increased to about eight qualified analyst-programmers. With continued aggressive support from the Central A.D.P. Staff and the Commissioner of Motor Vehicles, D.M.V. could be a "show place" A.D.P. Center in two years. The D.M.V. A.D.P. Staff should permanently remain a separate peripheral A.D.P. Staff, similar to the posture of the Comptroller's A.D.P. Staff and subject to the same controls from the Central Staff.

At some future time it may be practical to consolidate all computer programming for D.M.V., State Police and State Roads into one staff.

A.D.P. for the State Roads Commission

The State Roads Commission currently operates an I.B.M. 1620 computer and plans to upgrade this machine to a more powerful computer in the near future. The Commission has an A.D.P. Staff of four analyst-programmers. The great bulk of State Roads Data Processing involves engineering applications. At the present time, many State Roads accounting and payroll jobs are performed manually. Upon selection and approval of new hardware, the staff could be increased sufficiently to commence programming the State Roads non-computer administrative functions. For the long pull, consolidation of this staff with D.M.V. and Law Enforcement (State Police) should prove logical.

A.D.P. for the Department of Employment Security

The Department of Employment Security currently operates an I.B.M. 1401 computer. A staff of one analyst and two programmers provides programming support for this system. This Department of about 1,000 employees is Federally funded and Federally oriented. Therefore, its A.D.P. operation functions independently of State Central A.D.P. Staff control. Computerized applications revolve around the collection of unemployment taxes and the payment of unemployment benefits. This Committee was told that the major A.D.P. need here is for a computer application that would match client requests for employment against a current file of job opportunities. Remote terminals located in the various statewide Employment Security offices could be used to interrogate this file on a real time basis while the unemployed client was in the D.E.S. office.

Employment Security appears to have a satisfactory small-scale computer operation. However, since the operation is so Federally controlled and so alike throughout the 50 states, the Committee questions why the Federal Government has not developed for D.E.S. nationwide uniform A.D.P. computer applications. Certainly the Federal Government should be encouraged to do this.

There appears to be no reason why the Employment Security operation should not employ the same standard programming documentation procedures and common programming language recommended for other Maryland State A.D.P. operations. For the long range, it would seem desirable and efficient to include this staff as a separate programming group of the Central A.D.P. Staff.

A.D.P. for the State Police Department

Law enforcement is perhaps the most "exciting" computer application for State Government. It is probably the one that can most rapidly and dramatically prove the worth of computers in the public eye, and should be implemented as promptly as possible in Maryland. In this "real time" system, files would be established of convicted persons, wanted persons, stolen cars, identifiable stolen goods, etc. The policeman in the radio car or on the beat can interrogate this file in "real time" by radio, call box or telephone and receive virtually instant information. Computerized law enforcement systems are in use in several states. The experience of these states has been an improvement in police efficiency and police morale. Baltimore City and its surrounding counties (i.e., Baltimore, Howard, Anne Arundel) should be encouraged to implement a similar law enforcement application for the Baltimore Metropolitan Area. This system would be tied in with the State Police system, thus covering the entire State of Maryland. Both systems would also tie in with the F.B.I., N.C.I.C. computer system (National Crime Information Center), and, via this center, achieve instantaneous access to similar real time crime files in the other 49 states. This is not a "blue sky" application as many believe. It is practical and urgent and aggressive sponsorship should be exercised to guarantee its early implementation.

Currently the only State Police computer is a small scale Univac 1004 in which the Central Accidents Records Division is efficiently processing statistical data relative to accidents throughout the state. Most of the other State Police data processing is being performed manually or on punch card equipment.

The Department of Budget and Procurement has approved a systems analyst position for the State Police operation to thoroughly review its operation, recommend upgrading of hardware, and consolidation of data processing into one organization. The Committee believes this analyst should be recruited and assigned immediately in order to expedite this important Law Enforcement computerization.

Recruiting of a Law Enforcement programming group should be initiated by mid 1967 in anticipation of the systems analyst's recommendations. Although this A.D.P. Staff could work physically at Police Headquarters, the Committee suggests that the group initially be under direct supervision of the Central A.D.P. Staff. The State Police would be expected to operate the Law Enforcement system once it became operational. The computer vendor who wins the contract for this job should be required to provide at least two full time systems support personnel. The State Police computer should have sufficient capacity to perform both the "real time" Law Enforcement application plus all other State Police A.D.P. requirements. Once the initial Law Enforcement operation is cut over, it would appear logical to transfer the State Police programming group from the Central A.D.P. Staff, and form a combined D.M.V.-State Police-State Roads A.D.P. Staff.

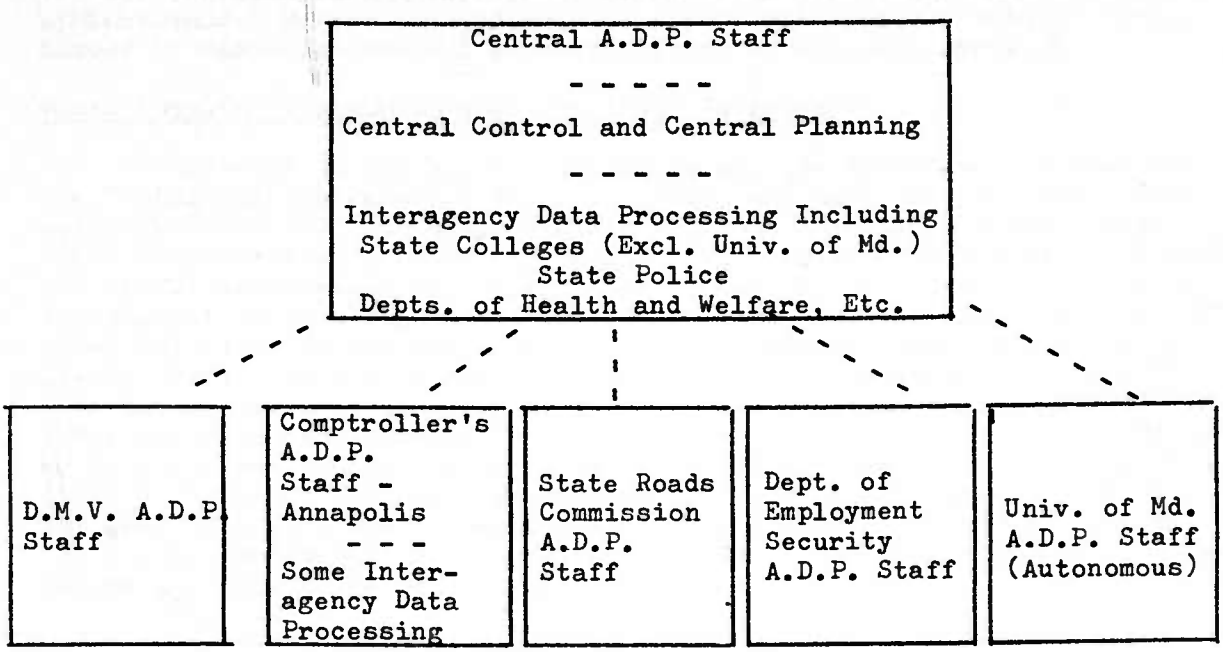
A.D.P. for the 100 or More Other State Departments, Agencies and Commissions

The preceding pages of this memorandum have commented upon the A.D.P. needs and plans of the major state departments and departmental groupings. As previously mentioned, there are considerably more than 100 smaller Maryland Government departments, agencies and commissions. A large number of these can effectively employ modern A.D.P. techniques to reduce expenses and to improve their quality and range of services. As they become more familiar and appreciative of the advantages of A.D.P., their demands for such services will increase. Most, if not all of these state organizations are too small to efficiently and effectively support their own separate (peripheral) A.D.P. organizations. As previously discussed, with certain logical exceptions, it is proposed that A.D.P. for these smaller agencies be handled and provided by the Central Staff Interagency programming group.

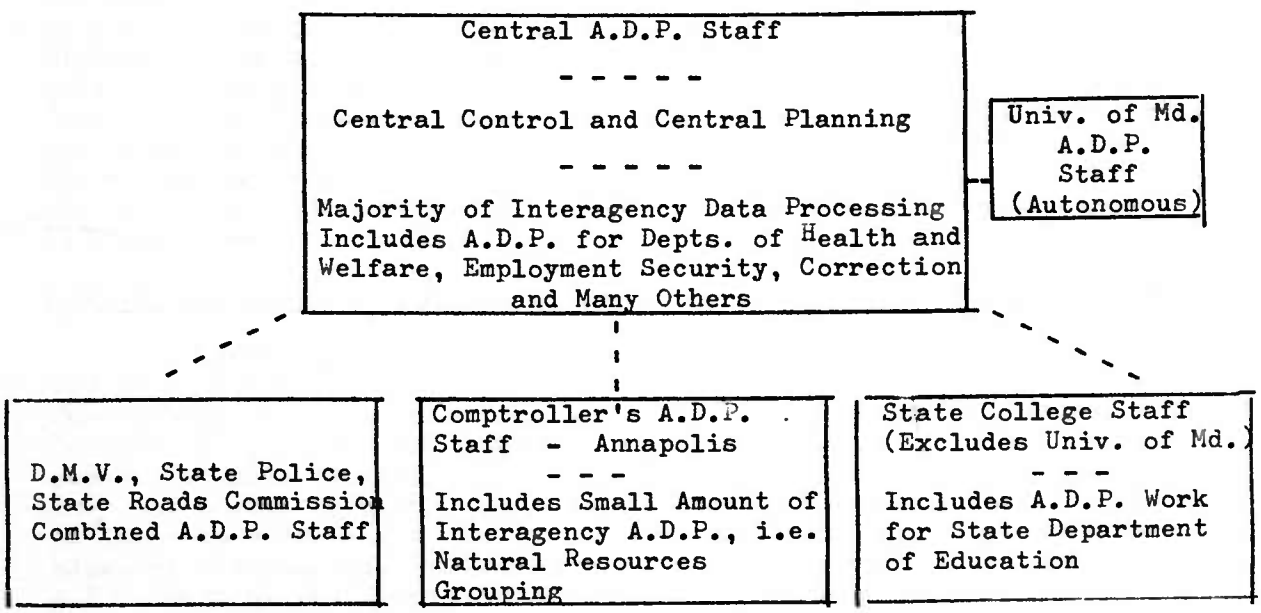
However, the Central Staff probably faces a year or two of strengthening and consolidation of current "Interagency" methods work before it can absorb any volume of additional work. During this several year period, the various smaller state organizations should concentrate upon the streamlining and improvement of current procedures. The larger of the "smaller organizations" could consider appointing one or more systems analysts within their operation to concentrate upon this improvement of current methods. Modest punch card mechanization should be considered with the approval of the Central Staff. Any current methods work of this nature will improve

the ability of these organizations to adapt to computerization when the Central A.D.P. Staff has developed the staff capability to absorb additional A.D.P. work.

Suggested State A.D.P. Organization - Short Range



Suggested State A.D.P. Organization - Long Range



Other Important Considerations Concerning State Automatic Data Processing

Until this point the report has concentrated on the continued need for high level support for State A.D.P., on the need for recruiting and developing a strong A.D.P. Staff, and upon A.D.P. organization and applications. Before concluding, the report will comment briefly upon a number of miscellaneous but important other A.D.P. considerations.

Total Computer Systems Concept for State Government

Experts on the A.D.P. subject stress the importance of applying the "total systems" concept to State government computer planning. They emphasize that the long range objective should be a fully computerized State Government Information System (S.I.S.), containing a variety of needed and useful information concerning each citizen of the State. Much of this information is available somewhere today within the State information structure, but it is fragmented, duplicated and probably inaccurate and incomplete. Under the S.I.S. concept, all files would be updated in "real time" - or daily - or as frequently as needed. Information, hopefully, will be quite accurate and instantly retrievable in "real time" via data terminals or by computer printout as required. The S.I.S. concept is entirely practical in terms of today's computer hardware and system design "know how." The Central A.D.P. Staff (Department of Budget and Procurement) is alert to the S.I.S. concept and will consider a computerized State Information System as its long range objective.

However, reaching the ultimate S.I.S. will require many years of concentrated and carefully planned A.D.P. effort. If Maryland can boast of a 90% complete S.I.S. in 10-12 years it will have made excellent progress, and, as a state, should compare quite favorably with the most progressive states. Progress towards the ultimate system must be made in discrete, orderly and modular steps. For example, if the applications currently being planned or considered (i.e., Comptrollers, State Police, D.M.V., State Colleges, Mental Institutions, Welfare) can be computerized and operating smoothly in 5 years, Maryland will be on a good track. These applications are natural A.D.P. building blocks that will provide the data base and computer logic for a large percent of the ultimate S.I.S. system.

Computerization as a Tool for State Government Control and Decision Making

There has been much said of the computer as a potential tool for top level government decision making and control in such areas as Revenue Forecasting, Tax Planning, Economic Forecasts, Expense Prediction, Budget Control, etc. With well planned and designed computer systems, this capability does and will exist. Normally this decision making capability does not become available early in the A.D.P. conversion process. Rather it tends to accompany or lag the implementation of basic systems. For example, tax planning, expense control, etc., must await implementation of all or part of the State Comptroller's application.

A.D.P. at the University of Maryland

The University of Maryland has two computer A.D.P. operations. One supports University administrative functions and operates under control of the University of Maryland Comptroller. Hardware here is a medium scale Honeywell H-200. This operation is considered by competent observers as quite efficient.

The other computer operation is that performed by the University of Maryland Computer Science Department. This department is charged with the triple function of: (1) providing a centralized computer service for all academic activities of the University, (2) building an educational program in computer science, and (3) conducting an active research program in the computer and computer-related sciences. The Computer Science Department operates a large scale I.B.M. 7094 and an I.B.M. 1401. Utilization of this equipment is high and additional hardware will be needed very shortly to meet current processing needs. To fulfill its long range charter, this department will require continuously increasing computer processing capacity.

The University of Maryland computer operation is the most sophisticated and advanced in the Maryland State Government. The computer science organization is considered by outside professional opinion to be the outstanding Computer Science Department in this region. It has outstanding leadership and direction. In several years, if aggressively supported by the Governor and Legislature, this can become one of the top Computer Science Departments in the United States.

For a number of reasons such an achievement can be most salutary for the entire State of Maryland:

1. It will provide a strong attraction for science based industry to settle in Maryland.
2. It will attract outstanding students, teachers and researchers to the University of Maryland.
3. It will provide a source of professionally trained computer personnel.
4. It can serve as a computer service bureau for State government research projects and activities.
5. It will be a credit to the State and to the University of Maryland.

For these reasons, this Committee urges continued top level support of the University of Maryland's plans to develop and expand its Computer Science Department. Because of its basic university character, because of its competence, and because of the University's current and proposed autonomous posture, it is suggested that University of Maryland A.D.P. operations be autonomous and independent of Central A.D.P. Staff control.

A reinforcing comment to this thought may be that in most other states, University A.D.P. Groups also function autonomously.

A.D.P. for the State Legislature

There has been little recorded progress in the area of employing computers to assist and facilitate the State legislative process. However, there appear to be many opportunities for facilitating the procedural aspects of legislative work through the use of computers. They could be used in the preparation of digests, indexes, summaries and successive prints of bills as they advance through various stages of consideration and revision; in codification and code revision and in performing the drudgery of legal research. There is a largely untapped opportunity for service in the Legislative area.

The States of Florida and Iowa have made some progress in computerizing the Legislative process. Specifically, during the Legislative session, a daily cross index of the Legislation in both houses is maintained to give the Legislators and public ready assistance in locating bills of interest by subject matter. It does not appear economically feasible to pay a year's rental for a computer to be employed only during the 70 days of the Legislature. However, it may be feasible to install one or more "input-output" devices in the State House for use by the Staff and to have this device connected over leased lines to an existing computer in either Annapolis or Baltimore. Implementation of this job, however, should wait until other states have made more progress in this area, and until greater A.D.P. Staff capability is available in Maryland. Successful completion of such an application would go far toward instilling confidence and enthusiasm among Legislators for State government computerization.

Federal-State-Local Coordination and Cooperation in the A.D.P. Area

In his message of March 22, 1966 to the General Assembly concerning modernization of the Maryland State Government, Governor Tawes stressed the importance and urgency of close cooperation and coordination between the State and Federal Governments and between the State government and local jurisdictions. This thought is particularly pertinent to State A.D.P. The increasing number of Federal-State programs in areas such as Welfare, Employment Security, War on Poverty, etc., that interface directly with state operations, will force standardization of A.D.P. input/output formats, statistical criteria and operating procedures. The Federal government is advancing rapidly in its A.D.P. sophistication and will demand that State governments keep pace.

The same general philosophy also applies to State-Local coordination. The needed Law Enforcement application described earlier in this report will force close Local-State coordination in the A.D.P. area. Welfare, Comptroller's Tax and D.M.V. applications are other applications that will force State-Local A.D.P. personnel to work closely together.

To encourage government A.D.P. cooperation at the three levels, it is recommended that initially one person on the Central Staff be assigned full time to this coordinative activity. Eventually, more than one person will need be assigned to this job. Formation of a Maryland State-Local Government A.D.P. Society or group would be desirable. Members of this professional group would include personnel from various state and local government A.D.P. organizations. They could meet monthly to review inter-government matters of mutual interest and to hear presentations on various pertinent Government A.D.P. subjects.

Council of State Governments - Super A.D.P. Staff

The Council of State Governments should be encouraged to establish a super "clearing house" A.D.P. Staff to serve the 50 states. Essentially, all states face the same A.D.P. problems and generally will be required to computerize the same applications. The larger states have resources to implement A.D.P. applications that smaller states cannot afford to tackle. There is excellent computerization being accomplished by individual states that could offer A.D.P. implementation savings to other states if system transferability could be achieved. A 50 state super staff could serve as a "clearing house" for successful, fully documented state computer applications. It could serve as a spring board for encouraging 50 state standardization of programming documentation procedures - thus enhancing interstate transferability of programs. It could encourage and head up special interstate project task forces organized to design and program applications that have multi-state application. It could enforce statistical homogeneity and standardization between states. The cost of such a staff shared by 50 states would be infinitesimal when compared to its worth and service.

Programming Standards

This subject has been mentioned a number of times previously in this report. However, because of its importance and urgency it is again reviewed. Standard statewide program documentation procedures are absolutely essential to accomplish successful state government computerization. Two persons on the Central Staff should devote full time to the programming standards job. Their responsibility should include the training of all new State A.D.P. personnel in programming standards and also the "police" role to see that these standards are rigidly adhered to.

In addition to standard documentation procedures, the Central Staff should enforce standard Computer Room operating procedures, standard tape library and documentation library procedures, standard input/output control procedures and standard machine utilization reporting.

Training of A.D.P. Staff and Clerical Personnel

The subject of formalized and effective training procedures and practices in an Automatic Data Processing environment has been virtually neglected by all State governments. Industry has not done itself proud in this important area. Training is a lengthy subject unto itself and

can only be mentioned briefly in this report. However, one person on the Central Staff should be assigned promptly to the study and development of training procedures. Initially, he would concentrate on the development of training for A.D.P. Staff and computer operating personnel, including such training courses as: advanced programming, computer concepts, console operation, tape library operation, etc. Later, but inevitably, the huge subject must be faced of developing training procedures and practices for the large numbers of clerical personnel who will perform clerical input/output and error correction assignments in the computer environment.

Floor Space Requirements for A.D.P. Staff and Computer Operations

Generally, space provided for Maryland systems-analyst personnel and computer operations is crowded and inadequate. This can only lead to poor housekeeping, sloppy operations, errors, lower morale and poor productivity.

All A.D.P. building and office space plans for the future should be executed to provide satisfactory space including good lighting, air conditioning and adequate storage. For analyst-programmers, in outside industry, a per capita allocation of about 100 square feet of bank-partitioned (cubical) space has proven satisfactory. Any building plans for Baltimore must recognize space requirements for the Central Staff. Since, in several years or so, this operation may include up to 60-70 staff personnel and at least two computers, a minimum of 10,000-13,000 sq. ft. should be allowed.

Operations Research A.D.P.

As state capability in Operations Research increases, Operations Research personnel will have increasing requirements for computer time. The Central A.D.P. Staff operation and the University of Maryland should be expected to serve as computer service bureaus for these requirements.

Computer Vendors

As stated previously, this report is silent as to preferability of one computer manufacturer's hardware vs. that of another. It is logical that an enterprise as large as the State of Maryland should have mulitple computer hardware suppliers. It also appears that today, a number of computer vendors offer competitive equipment. In selecting new hardware an important criteria should be the vendor's guarantee of providing full-time systems personnel support. This is particularly urgent for the next several years as the State A.D.P. Staff gathers strength and capability.

Computer Consultants

There are a large and growing number of firms that offer computer consulting services. Some of these firms have wide experience and considerable knowledge of what other states are implementing in the way of computer applications. It would seem prudent for the State to make

modest use of such services over the next several years, assuming, of course, that the consultant had proven and professional knowledge of the computer application being studied. Consultant firms should be employed to study, appraise and provide counsel, but not to perform actual programming services.

State A.D.P. Advisory Committee

It is recommended that an A.D.P. Advisory Committee be appointed to counsel the State of Maryland over the next several years. This Committee should consist of members of the business community competent in computer operations and interested in advancement of State Government. This Committee could function as a committee of the Governor's Science Resources Advisory Board. A number of other states have similar committees and apparently have found this approach salutary.

Conclusion

The Committee has thoroughly enjoyed and profited from this assignment. It is convinced that well planned and orderly computerization of State operations is essential and inevitable. If this endeavor continues to be encouraged and supported by top state officials, the long term results in improved service and expense will be dramatic.